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Title:	Coupling structures for active and passive integrated optoelectronic components and circuits on silicon
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Abstract

Efficient coupling structures are important for the realization of reliable and economical integrated optical circuit applications. This paper presents a new approach for the simulation of an anisotropic plasma etching process in silicon based on a string point model as well as the realization and the results of etching processes in silicon, silicon dioxide, silicon oxinitride and silicon nitride which are fundamental for the fabrication of coupling structures. The connections to active and passive components were fabricated using plasma etching and deposition processes which are compatible with C-MOS or BIC-MOS technology. The realized waveguide-detector structures with vertical and horizontal silicon PIN-diodes exhibit efficiencies close to 90% for wavelength below 1.1 micrometers . The diodes can detect signals of modulation frequencies of more than 400 MHz due to horizontal light injection and capacitances less than 1 pF. Fiber-detector coupling structures with U-grooves for the fiber alignment containing such detectors show similar results. The necessary accuracy of the etched depth of the U-grooves for fiber-detector coupling is +/- 2 micrometers in contrast to a fiber- waveguide coupling which requires a reproducible accuracy of the process better than 0.5 micrometers . A reduction of coupling losses due to the necessary close tolerances is accomplished by waveguide tapers. The simulation, realization and results for such structures are presented in the paper. Also laser diode--fiber connections require extremely close tolerances. The design of a micro-optical bench realized by plasma etching and a selfaligning soldering process is presented, which allows such tolerances.

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